**CONJUGATE ROOT THEOREM**

* A polynomial with real coefficients (e.g. , where and are real) that has complex number roots will have them occur in conjugate pairs.
* This is because when you multiply conjugate pairs, the result is a real number.
* Example: .
* The Conjugate Root Theorem helps us find the roots of cubics which have some complex roots.

**CUBIC EQUATIONS WITH TWO COMPLEX ROOTS**

Example 1: Find the roots of , given that one root is .

* If is a root, the second root must be (according to the Conjugate Root

Theorem).

* Therefore, two factors of the cubic must be and .
* The third factor can be written as .
* You can fully expand the LHS and compare to the RHS to solve for , but we really only need to inspect the constant term:
* Therefore, the third factor is and so the third root is 2.
* The three roots are and 2.

Example 2: Use the factor theorem and division to solve the following cubic:

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* Using the factor theorem on factors of -10: 1, 2, 5, 10, -1, -2, -5, 10 we find that f(-2)=0 meaning is a factor.



* Dividing into , we

get .

* Solve using the quadratic formula:
* Therefore the roots for the cubic are -2, , and .

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